

What is claimed is:

1. A thermoform process comprising the steps of:

- placing a first sheet in a first frame and transferring the first sheet into an oven;
- heating the first sheet in the oven to a predetermined temperature;
- transferring and molding the first sheet onto a half mold of a vacuum thermoforming mold forming a first headliner part;
- placing a second sheet in a second frame and transferring the second sheet into the oven or, if available, an alternate oven;
- heating the second sheet in the oven to a predetermined temperature;
- transferring and molding the second sheet onto an opposing half mold of the vacuum thermoforming mold forming a first headliner part;
- compressing the half molds of the thermoforming mold fusing regions of the first headliner part to the second headliner part, thereby forming a unified part having at least one interior compartment having impact cushioning;
- ejecting the unified part; and
- trimming and finishing the unified part.

2. The thermoform process as claimed in claim 1, wherein the first sheet is a low pressure, thermoformable, thermoplastic composite comprised of polypropylene and long chopped glass fibers.
3. The thermoform process as claimed in claim 1, wherein the second sheet is a low pressure, thermoformable, thermoplastic composite comprised of polypropylene and long chopped glass fibers.
4. The thermoform process as claimed in claim 2, wherein the first headliner part is further comprised of a layer of a fusing adhesive.
5. The thermoform process as claimed in claim 4, wherein the second headliner part is further comprised of a layer of a fusing adhesive.
6. The thermoform process as claimed in claim 5, wherein the first sheet is vacuum molded on the half mold forming the first headliner part, wherein the layer of fusing adhesive is on a side of the first sheet that is not in contact with the half mold.
7. The thermoform process as claimed in claim 6, wherein the second sheet is vacuum molded on the opposing half mold forming the second headliner part, wherein the layer of fusing adhesive is on a side of the second sheet that is not in contact with the opposing half mold.

8. A thermoform process according to claim 1, further comprising the steps of:

after heating the first sheet in the oven to the predetermined temperature, transferring the heated first sheet to a thermoforming mold having matched mold halves;

transferring a cover-stock material to the thermoforming mold having matched mold halves;

compressing and fusing the cover-stock material to the first sheet forming a covered first headliner part; and

transferring the covered first headliner part to a second mold and positioning the covered first headliner part in the lower half mold of the vacuum thermoforming mold.

9. The thermoform process as claimed in claim 8, wherein the cover stock material is comprised of a fabric, a film, a felt, or a skin such as a fur or a leather.

10. The thermoform process according to claim 7, wherein the cover stock material is further comprised of an underlying layer of foam.

11. The thermoform process according to claim 9, wherein the cover stock material is further comprised of an intra-layer adhesive.

12. The thermoform process as claimed in claim 7, wherein compressing the half molds of the thermoforming mold fuses the layer of adhesive on the first headliner part to the layer of adhesive on the second headliner part, thereby forming a covered unified part.

13. A thermoform process according to claim 8, further comprising the steps of:

after heating the second sheet in the oven to the predetermined temperature, transferring the heated first sheet to a thermoforming mold having matched mold halves;

transferring a reinforcing scrim material to the thermoforming mold having matched mold halves;

compressing and fusing the reinforcing scrim material to the second sheet forming a scrim reinforced second headliner part; and

transferring and positioning the scrim reinforced second headliner part onto the opposing half mold of the vacuum thermoforming mold.

14. The thermoform process according to claim 8, wherein the cover stock material is further comprised of an underlying layer of foam.

15. The thermoform process according to claim 14, wherein the cover stock material is further comprised of an intra-layer adhesive.

16. The thermoform process as claimed in claim 15, wherein compressing the half molds of the thermoforming mold adheres the layer of fusing adhesive on the covered first headliner part to the layer of fusing adhesive on second headliner part, thereby forming a covered unified part.

17. The thermoform process according to claim 13, wherein the cover stock material is further comprised of an underlying layer of foam.

18. The thermoform process according to claim 17, wherein the cover stock material is further comprised of an intra-layer adhesive.

19. The thermoform process as claimed in claim 18, wherein compressing the half molds of the thermoforming mold adheres the layer of fusing adhesive on the covered first headliner part to the layer of fusing adhesive on the reinforced scrim second headliner part, thereby forming a covered reinforced scrim unified part.

20. The thermoform process as claimed in claim 1, wherein the part is a headliner.

21. The thermoform process as claimed in claim 12, wherein the covered part is a finished headliner covered with a fabric, a film, a felt, or a skin such as a fur or a leather.

22. The thermoform process as claimed in claim 19, wherein the covered reinforced scrim part is a finished reinforced headliner covered with a fabric, a film, a felt, or a skin such as a fur or a leather.

23. A thermoform process according to claim 1, further comprising the step of:

after compressing the half molds of the thermoforming mold fusing the first headliner part to the second headliner part thereby forming a part; injecting foam into the interior compartment.

24. A thermoform process according to claim 1, further comprising the step of:

after compressing the half molds of the thermoforming mold fusing the first headliner part to the second headliner part thereby forming a part; injecting insulation into the interior compartment.

25. A thermoform process according to claim 8, further comprising the step of:

after compressing the half molds of the thermoforming mold fusing the covered first headliner part to the second headliner part thereby forming a part; injecting foam into the interior compartment.

26. A thermoform process according to claim 8, further comprising the step of:

after compressing the half molds of the thermoforming mold fusing the covered first headliner part to the second headliner part thereby forming a part; injecting insulation into the interior compartment.

27. A thermoform process according to claim 13, further comprising the step of:

after compressing the half molds of the thermoforming mold fusing the covered first headliner part to the reinforced scrim second headliner part thereby forming a part; injecting foam into the interior compartment.

28. A thermoform process according to claim 1, further comprising the step of:

after compressing the half molds of the thermoforming mold fusing the covered first headliner part to the reinforced scrim second headliner part thereby forming a part; injecting insulation into the interior compartment.

29. A thermoform process according to claim 8, further comprising the step of:

prior to compressing the half molds of the thermoforming mold fusing the covered first headliner part to the second headliner part thereby forming a part; positioning wiring, fasteners, duct work and reinforcing components, and acoustic enhancing materials into what will become the interior compartment.

30. A thermoform process according to claim 1, further comprising the step of:

during finishing, performing as needed secondary punching, laser, water-jet and knife trimming, and vibration, ultrasonic and hot plate welding.

31. A thermoform process according to claim 8, further comprising the step of:

during finishing, performing as needed secondary punching, laser, water-jet and knife trimming, and vibration, ultrasonic and hot plate welding.

32. A thermoform process according to claim 13, further comprising the step of:

during finishing, performing as needed secondary punching, laser, water-jet and knife trimming, and vibration, ultrasonic and hot plate welding.

33. A thermoform process according to claim 1, further comprising the step of:

after placing a first sheet in a first frame and transferring the first sheet into a preheat oven;
preheating the first sheet.

34. A thermoform process according to claim 33, further comprising the step of:

after placing a second sheet in a second frame and transferring the second sheet into a preheat oven;
preheating the second sheet.

35. A headliner for a vehicle having excellent head impact countermeasures (HIC) properties, said headliner comprises:

a first headliner part having a liner side and an opposing side, wherein the first headliner part has a molded shape that is substantially the visible form for the headliner as seen inside the vehicle;

a second headliner part having a roof side and a compartment side, wherein the second headliner part is molded to reinforce the first sheet, attach the headliner to the roof, form at least one interior compartment with flexible walls when combined with the first

headliner part, and form an intra-panel space between the roof and the second headliner part;

wherein the opposing side of the first sheet and the compartment side of the second headliner part are adhered to each other, therein forming the least one interior compartment that has excellent head impact countermeasures (HIC) properties; and

wherein the intra-panel space produces sound dampening.

36. The headliner as claimed in claim 35, wherein the first headliner part is a first sheet of a low pressure, thermoformable, thermoplastic composite comprised of polypropylene and long chopped glass fibers.

37. The headliner as claimed in claim 36, wherein the second headliner part is a second sheet of a low pressure, thermoformable, thermoplastic composite comprised of polypropylene and long chopped glass fibers.

38. The headliner as claimed in claim 37, wherein the first sheet has a flexural modulus between 900 and 1800 MPa (ASTM D792), and a multi-axial impact between 5 and 7 J (ASTM D3763).

39. The headliner as claimed in claim 38, wherein the second sheet has a flexural modulus between 900 and 1800 MPa (ASTM D792), and a multi-axial impact between 5 and 7 J (ASTM D3763).

40. A headliner according to claim 35, wherein the first headliner part further comprises a cover-stock material fused to the liner side.

41. The headliner as claimed in claim 40, wherein the cover stock material is comprised of a fabric, a film, a felt, or a skin such as a fur or a leather.

42. The headliner as claimed in claim 41, wherein between the cover stock material and the first sheet is an intra-layer adhesive.

43. The headliner as claimed in claim 41, wherein the cover stock material has sound dampening properties.

44. The headliner as claimed in claim 40, wherein the cover stock material is further comprised of an underlying layer of foam.

45. A headliner according to claim 35, wherein the second headliner part further comprises a reinforcing scrim material that is bonded to the roof side of the second headliner part.

46. A headliner according to claim 35, wherein the second headliner part is further comprised of a layer of a fusing adhesive on the compartment side of the second headliner part.

47. A headliner according to claim 46, wherein the first headliner part is further comprised of a layer of a fusing adhesive on the opposing side of the first headliner part.

48. The headliner according to claim 47, wherein the layer of fusing adhesive on the compartment side of the second headliner part is fused with the fusing adhesive layer of adhesive on the opposing side of the first headliner part.